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The second "Einstein paradox".

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Abstract

Time invariance problem of a photon absorption process in atoms and molecules is discussed.

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The Dirac equation, in the case of electromagnetic interaction, is not invariant under unitary time inversion [1]. However, a common opinion exists that the electromagnetic interaction in nature must be time invariant [2]. The attempts to find what is a proof basis of such point of view in a special case of a photon absorption process in atoms and molecules give only indistinct references point at Einstein's works [3].

If one keeps in mind the Einstein coefficients of absorption and stimulated emission, this basis is erroneous. The Einstein coefficients characterize integral cross-section of optical transition. Time invariance preserving demands equality not only the integral cross-section, but also it demands equality of spectral width of forward and backward optical transitions. Einstein nothing writes about the width of optical transitions. So, Einstein coefficients have no direct connection to T-invariance of photon absorption process.

There is also exists the Einstein's opinion "that physics could be restricted to the time-symmetric case for which retarded and advanced fields are equivalent" [4]. Obviously there is a main basis of existing point of view, because of any experimental result in proof of T-invariance preserving in a photon absorption process is absent.

In contrast, for the opposite point of view we have one direct and complete experimental proof and a number of indirect evidences. The direct and complete experimental proof is connected with the experimental study of the so-called line wings [5]. The experiments clearly show a very strong T-invariance violation in a photon absorption process in molecules. Although the integral cross-section of forward and backward optical transitions are obviously the same, the spectral width and cross-section for such transitions differ on several order of magnitude [6].

The concept of T-invariance violation of a photon absorption process is a good basis for explanation of most effects in nonlinear optics from a pure quantum position without using any semiclassical approximation [7]. There

are indirect experimental proofs. The most striking example is the population transfer effect in the case of sweeping a resonance conditions in a two level system. On the basis of T-invariance violation of absorption process this effect has a simple and natural explanation [8]. In contrast, on the basis of semiclassical wave approximation theory the explanation of this effect looks like as the ravings of a madman [9].

On the whole such situation may be called as the second "Einstein paradox" [a]. When great authority and delusion of one scientist delay on decades progress of physical theory in some fields of scientific research. So, do we have "Einstein paradox" in quantum optics?

[a] The first paradox is connected with quantum statistics [10,11].

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